

REMARKS

The AMENDMENT UNDER 37 CFR 1.111 is filed in reply to the outstanding Office Action of April 19, 2004, and is believed to be fully responsive thereto for reasons set forth below in greater detail.

Responsive to paragraphs 1-2 of the Office Action, each of independent claims 9, 14 and 19 has been amended in a similar manner to further clarify the batch factor, and also historical data in the context of previous lot runs that were run prior in time to a current lot run that is currently being run. Moreover, claims 11 and 16 have been amended to clarify that the recited "1" refers to an exposure dose ratio of 1.

Reconsideration is respectfully requested of the rejections of: claims 9-11, 14-16 and 18-19 as being anticipated by Whiting; claims 9-10 as being anticipated by Yoon et al.; and claims 9-10, 14-15 and 18-19 as being anticipated by Mack; particularly in view of the clarifying and limiting amendments to each of independent claims 9, 14 and 19.

The Present Invention

The present invention is directed to a method for controlling an exposure dose in a lithographic system. Each of independent claims 9 and 14 is being amended to further set forth and clarify the lithographic system wherein photoresist material is applied to semiconductor wafers, and a reticle is used for developing images in the photoresist material on the semiconductor wafers, and wherein the system operates with successive lot runs, including previous lot runs that were run prior in time and a current lot run that is currently being run, and the photoresist apply tool is subject to photoresist material batch changeover. Independent claim 19 is also amended to clarify the batch factor, material performance, and wherein the system operates with successive lot runs,

including previous lot runs that were run prior in time and a current lot run that is currently being run, and the material is subject to material batch changeover.

Independent claims 9 and 14 have clarified and defined the calculation of the batch factor, that is an exposure dose ratio of current exposure dose performance to previous exposure dose performance, and is based on “historical data” relating to batch factors and optimum exposure doses obtained from previous lot runs that were run prior in time to the current lot run and before the resist batch changeover. Thus, as new resist material enters the system, and the exposure dose required to maintain a proper image size moves, a new calculation of a dose ratio or batch factor is performed for the reticle.

Whiting

Initially, it is noted that the Official Action is very confusing when referring to Whiting, and contains numerous errors and mistakes. In the rejection in paragraph 4, the references are to col. 9 which contains claims, and the reference to col. 9, lines 38-55 is to subparagraph (c) of claim 3 and the first two lines of the preamble of claim 4, which is obviously incorrect.

Whiting is completely unrelated to the present invention, and the confusing references to Whiting make it uncertain if Whiting is the correct reference in the rejection.

Whiting specifically discloses an “arrangement for the processing of wafers on post-exposure bake hotplates along multiple processing paths, each of which may result in different integrated circuit images, and to adjust the exposure dose based on the path through the process, so as to render the output and resultant image size of each path identical to each other and close to a target value.” col. 1, lines 10-18.

“The process enables a precise control over image size of integrated circuits formed on semiconductor wafers without having to constantly vary the temperatures of the hotplate to which the semiconductor device is conveyed subsequent to exposure while using dosage adjustment based on feedback information of image size to permit identical output from multiple hotplates despite temperature differences between them.” col. 5, lines 53-60.

It is significant to note that Whiting does not disclose or teach anything related to either a “batch changeover”, which is the problem addressed by the present invention, or a “batch factor” or an “exposure dose ratio,” and so is just not that pertinent to the present invention.

Yoon, et al.

Initially, it is noted that the Office Action is very confusing when referring to Yoon. Paragraph 5 opens with a rejection of claims 9-10 as being anticipated by Yoon, and then the third paragraph of paragraph 5 refers to claim 13 and Whiting, and the next paragraph refers to claims 14-15, none of which are involved in the rejection.

The Examiner alleges that Yoon at Col. 2, lines 35-39, calculates batch data by using historical data/initial set of exposure control parameters to adjust exposure dose based on a calculated batch factor.

Applicants’ respectfully disagree. Yoon's patent is simply directed to a method/system for exposing a wafer, using in-situ tooling to determine the latent (unexposed) image characteristics, and then altering the tool based on that information. Yoon basically refers to many of the ways in which photolithography can be altered, not how to control to a batch factor or any of the other intricacies as set forth in the claims of

the present invention. For example, contrary to the Examiner's indication, Yoon describes at Col 2, lines 35-39 a simple feedback based on measurements. Yoon describes simply observing the optical characteristics of an exposed photoresist by a microscope, and describes broadly using the observed optical characteristics to control subsequent exposures of photoresist, without disclosing or teaching anything about the details of independent claims 9, 14 and 19. Furthermore, contrary to the Examiner's indication, Yoon describes at Col. 6, line 59 the details of the scanner (tool) which can be learned at a first level and transferred to other levels without having to develop the exposed photoresist.

It is significant to note that Yoon does not disclose or teach anything related to either a "batch changeover", which is the problem addressed by the present invention, or a "batch factor" or an "exposure dose ratio," and so is just not that pertinent to the present invention.

Thus, respectfully, Yoon is not relevant to the present claims of the invention as Yoon does not teach or suggest gathering data on the resist and using it to control the parameters used to expose the resist based on resist data. The present invention rather, utilizes measurement data from the developed resist to alter the way it is exposed on multiple tools, levels, features, etc. and, particularly, taking developed resist data and incorporating it with historical resist data in order to determine how to control multiple levels and tools.

Mack

Furthermore, Mack's disclosure is almost identical to that of Yoon and, is likewise not relevant for the reasons that it additionally discusses in-situ measurements of

undeveloped resist which may be feedback to the tool in order to make adjustments.

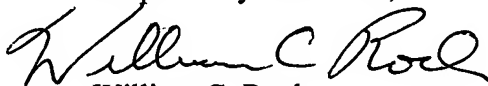
Again, this has nothing to do with taking developed resist data and incorporating it with historical resist data in order to determine how to control multiple levels and tools.

Mack discloses a method for in situ photoresist measurements and exposure control. The measurements are used in a feedback loop to control the exposure dose, i.e. the exposure is turned off after predetermined absorption and reflectivity data are measured. The method however, does not address the need to monitor the effects of a change in photoresist batch characteristics.

It is significant to note that Mack does not disclose or teach anything related to either a "batch changeover", which is the problem addressed by the present invention, or a "batch factor" or an "exposure dose ratio," and so is just not that pertinent to the present invention.

This application is now believed to be in condition for allowance, a Notice of Allowance is respectfully requested. If the Examiner believes a telephone conference might expedite prosecution of this case, it is respectfully requested that he call applicant's attorney at (516) 742-4343.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "William C. Roch". The signature is fluid and cursive, with the first name "William" and last name "Roch" clearly distinguishable.

William C. Roch
Registration No. 24,972

SCULLY, SCOTT, MURPHY & PRESSER
400 Garden City Plaza
Garden City, New York 11530
(516) 742-4343
WCR:jf